

[Document Name] CLAIMS

1. A heat exchanger comprising:
a case; and
a heating element accommodated in said case,
5 a flow path through which a fluid flows being formed between
an outer surface of said heating element and an inner surface
of said case,
said heat exchanger further comprising a flow velocity
conversion mechanism that changes a flow velocity in at least
10 a part of said flow path.
2. The heat exchanger according to claim 1, wherein said
flow velocity conversion mechanism changes the flow velocity of
the fluid so as to increase the flow velocity within said flow
path.
- 15 3. The heat exchanger according to claim 1, wherein said
flow velocity conversion mechanism is configured so as to narrow
at least a part of said flow path.
4. The heat exchanger according to claim 3, wherein said
flow velocity conversion mechanism is configured so as to narrow
20 the downstream side of said flow path.
5. The heat exchanger according to claim 1, wherein said
flow velocity conversion mechanism is configured such that a flow
path cross section continuously narrows toward the downstream
side of said flow path.
- 25 6. The heat exchanger according to claim 1, wherein said

flow velocity conversion mechanism is configured such that a flow path cross section gradually narrows toward the downstream side of said flow path.

7. The heat exchanger according to claim 2, wherein
5 said case has a plurality of fluid inlets provided from the upstream side to the downstream side of said flow path, and said flow velocity conversion mechanism is composed of said plurality of fluid inlets.

8. The heat exchanger according to claim 2, wherein said
10 flow velocity conversion mechanism comprises an other fluid introduction mechanism for introducing, in order to increase the flow velocity of the fluid within said flow path, another fluid into said flow path.

9. The heat exchanger according to claim 8, wherein the
15 other fluid includes gas.

10. The heat exchanger according to claim 1, wherein said flow velocity conversion mechanism comprises a turbulent flow generation mechanism that generates turbulent flow in at least a part of said flow path.

20 11. The heat exchanger according to claim 1, wherein said flow velocity conversion mechanism is provided on an inner wall of said case.

12. The heat exchanger according to claim 1, wherein said flow velocity conversion mechanism is provided on a surface of
25 said heating element.

13. The heat exchanger according to claim 1, wherein said flow velocity conversion mechanism is formed of a member separate from said heating element and said case.

14. The heat exchanger according to claim 1, wherein said
5 flow velocity conversion mechanism comprises a flow velocity conversion member provided so as to form a clearance between the flow velocity conversion mechanism and said heating element.

15. The heat exchanger according to claim 1, wherein said
10 flow velocity conversion mechanism comprises a flow velocity conversion member provided so as to form a clearance between the flow velocity conversion mechanism and the inner wall of said case.

16. The heat exchanger according to claim 1, wherein said
15 flow velocity conversion mechanism comprises a flow direction conversion mechanism that converts the flow direction of the fluid within said flow path.

17. The heat exchanger according to claim 1, wherein said flow velocity conversion mechanism is provided in at least a part of the upstream or the downstream of said flow path.

20 18. The heat exchanger according to claim 1, wherein said flow velocity conversion mechanism is intermittently provided within said flow path.

19. The heat exchanger according to claim 1, wherein said
25 flow velocity conversion mechanism is provided in a region where the surface temperature of said heating element is not less than

a predetermined temperature.

20. The heat exchanger according to claim 1, wherein said flow velocity conversion mechanism is provided in a region where the surface temperature of said heating element is not less than
5 a predetermined temperature and a region in the vicinity and on the upstream side thereof.

21. The heat exchanger according to claim 16, wherein said flow direction conversion mechanism converts the flow direction of the fluid supplied to said flow path into the swirling
10 direction.

22. The heat exchanger according to claim 16, wherein said flow direction conversion mechanism comprises a guide provided in at least a part of said flow path.

23. The heat exchanger according to claim 16, wherein
15 said flow direction conversion mechanism comprises a spiral member for converting the flow direction of the fluid within said flow path into the swirling direction.

24. The heat exchanger according to claim 23, wherein the spiral member has a non-uniform pitch.

20 25. A heat exchanger comprising:

a case; and

a heating element accommodated in said case,

a flow path through which a fluid flows being formed between

an outer surface of said heating element and an inner surface

25 of said case,

said heat exchanger further comprising a fluid reducing material for lowering an oxidation/reduction potential of the fluid within said flow path.

26. The heat exchanger according to claim 25, wherein
5 said fluid reducing material includes magnesium or a magnesium alloy for lowering the oxidation/reduction potential of the fluid by reaction with the fluid.

27. The heat exchanger according to claim 25, further comprising
10 a flow velocity conversion mechanism that changes the flow velocity in at least a part of said flow path,
said flow velocity conversion mechanism being formed of said fluid reducing material.

28. A heat exchanger comprising:
15 a case; and
a heating element accommodated in said case,
a flow path through which a fluid flows being formed between an outer surface of said heating element and an inner surface of said case,

20 said heat exchanger further comprising an impurity removal mechanism that physically removes impurities within said flow path.

29. The heat exchanger according to claim 28, wherein
said impurity removal mechanism removes the impurities utilizing
25 the flow of the fluid within said flow path.

30. The heat exchanger according to claim 28, wherein said impurity removal mechanism is so configured as to change the flow of the fluid within said flow path into turbulent flow.

31. The heat exchanger according to claim 30, wherein
5 said impurity removal mechanism comprises a spiral spring.

32. The heat exchanger according to claim 31, wherein the spiral spring has at least one free end.

33. The heat exchanger according to claim 28, wherein said impurity removal mechanism comprises
10 a fluid supply device that supplies a fluid to said flow path at a pulsating pressure to remove impurities at said pulsating pressure.

34. The heat exchanger according to claim 33, wherein said fluid supply device supplies the fluid to said flow path
15 at the pulsating pressure after said heating element is increased to not less than a predetermined temperature.

35. A washing apparatus that sprays a fluid supplied from a water supply source on a portion to be washed, comprising:
a heat exchanger that heats the fluid supplied from said
20 water supply source;

a spray device that is connected to the downstream of said heat exchanger, to spray the fluid supplied from said heat exchanger on said portion to be washed; and

a flow rate adjuster that adjusts the flow rate of the
25 fluid supplied to said heat exchanger such that in an operation

for washing said heat exchanger, the flow rate of the fluid supplied to said heat exchanger is higher than that at the time of an operation for washing said portion to be washed by said spray device.

5 36. The washing apparatus according to claim 35, wherein said flow rate adjuster adjusts the flow rate of the fluid supplied to said heat exchanger at the time of the operation for washing the portion to be washed by said spray device.

 37. The washing apparatus according to claim 35, further
10 comprising

 a main flow path that introduces the fluid into the spray device,

 a sub-flow path that introduces the fluid into a portion other than said spray device, and

15 a flow path switcher that is provided between said heat exchanger and said spray device to selectively communicate one of said main flow path and said sub-flow path to said heat exchanger.

 38. The washing apparatus according to claim 37, wherein said flow rate adjuster and said flow path switcher are integrally
20 formed.

 39. The washing apparatus according to claim 37, wherein said sub-flow path is provided so as to introduce the fluid into a surface of said spray device.

 40. The washing apparatus according to claim 35, further
25 comprising a bypath flow path that is provided so as to branch

off from the downstream of said heat exchanger and to which the fluid discharged from said heat exchanger is supplied at the time of the operation for washing said heat exchanger.

41. The washing apparatus according to claim 35, further
5 comprising

a switch for issuing a command to perform the operation for washing said heat exchanger,

said flow rate adjuster adjusting the flow rate of the fluid supplied to said heat exchanger in response to an operation
10 of said switch such that the flow rate of the fluid supplied to said heat exchanger is higher than that at the time of the operation for washing the human body by said spray device.

42. The washing apparatus according to claim 35, further
comprising

15 a toilet seat, and

a seating detector that detects seating on said toilet seat,

said flow rate adjuster not adjusting the flow rate at the time of the operation for washing said heat exchanger when
20 said seating detector detects the seating.

43. The washing apparatus according to claim 35, wherein said flow rate adjuster adjusts the flow rate of the fluid supplied to said heat exchanger such that after the operation for washing the human body by said spray device, the flow rate of the fluid
25 supplied to said heat exchanger is higher than that at the time

of the operation for washing the human body by said spray device.

44. The washing apparatus according to claim 35, wherein said washing apparatus is mounted on a toilet bowl, and further comprising

5 a human body detector that detects the human body employing said toilet bowl,

said flow rate adjuster not adjusting the flow rate at the time of the operation for washing said heat exchanger when said human body detector detects the human body.

10 45. The washing apparatus according to claim 35, further comprising a power controller that changes power supplied to said heat exchanger at the time of the operation for washing said heat exchanger.

46. A washing apparatus that sprays a fluid supplied from
15 a water supply source on a portion to be washed of the human body, comprising:

a heat exchanger that heats the fluid supplied from said water supply source; and

a spray device that sprays the fluid heated by said heat
20 exchanger on said human body,

said heat exchanger comprising

a case, and

a heating element accommodated in said case,

a flow path being formed between an outer surface of said
25 heating element and an inner surface of said case,

said heat exchanger further comprising a flow velocity conversion mechanism that changes a flow velocity in at least a part of said flow path.

47. A washing apparatus that sprays a fluid supplied from
5 a water supply source on a portion to be washed of the human body, comprising:

a heat exchanger that heats the fluid supplied from said water supply source; and

a spray device that sprays the fluid heated by said heat
10 exchanger on said human body,

said heat exchanger comprising

a case, and

a heating element accommodated in said case,

a flow path being formed between an outer surface of said
15 heating element and an inner surface of said case, and

said heat exchanger further comprising a fluid reducing material for lowering an oxidation/reduction potential of the fluid within said flow path.

48. A washing apparatus that sprays a fluid supplied from
20 a water supply source on a portion to be washed of the human body, comprising:

a heat exchanger that heats the fluid supplied from said water supply source; and

a spray device that sprays the fluid heated by said heat
25 exchanger on said human body;

said heat exchanger comprising
a case, and
a heating element accommodated in said case,
a flow path being formed between an outer surface of said
5 heating element and an inner surface of said case,
said heat exchanger further comprising an impurity removal
mechanism that physically removes impurities within said fluid.

49. A washing apparatus that washes a washing object using
a fluid supplied from a water supply source, comprising:
10 a washing tub accommodating said washing object;
a heat exchanger that heats the fluid supplied from said
water supply source; and
a supply device that supplies the fluid heated by said
heat exchanger to said washing tub,
15 said heat exchanger comprising
a case, and
a heating element accommodated in said case,
a flow path being formed between an outer surface of said
heating element and an inner surface of said case,
20 said heat exchanger further comprising a flow velocity
conversion mechanism that changes a flow velocity in at least
a part of said flow path.

50. A washing apparatus that washes a washing object using
a fluid supplied from a water supply source, comprising:
25 a washing tub accommodating said washing object;

a heat exchanger that heats the fluid supplied from said water supply source; and

a supply device that supplies the fluid heated by said heat exchanger to said washing tub,

5 said heat exchanger comprising

a case, and

a heating element accommodated in said case,

a flow path being formed between an outer surface of said heating element and an inner surface of said case,

10 said heat exchanger further comprising a fluid reducing material for lowering an oxidation/reduction potential of the fluid within said flow path.

51. A washing apparatus that washes a washing object using a fluid supplied from a water supply source, comprising:

15 a washing tub accommodating said washing object;

a heat exchanger that heats the fluid supplied from said water supply source; and

a supply device that supplies the fluid heated by said heat exchanger to said washing tub,

20 said heat exchanger comprising

a case, and

a heating element accommodated in said case,

a flow path being formed between an outer surface of said heating element and an inner surface of said case,

25 said heat exchanger further comprising an impurity removal

mechanism that physically removes impurities within said fluid.